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Exploratory Analyses of Refined Predictors of Subjective ESP Experiences and Temporal Lobe Dysfunction in a Neuropsychiatric Population

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Abstract

Following up on previous research indicating a relationship between symptoms of temporal lobe dysfunction (TLD) and subjective paranormal experiences, exploratory logistic regression analyses were conducted to discover specific predictors of subjective ESP experiences (S-ESP) among 100 neuropsychiatric patients of Neppe. Predictors included gender, age, 16 items from a questionnaire measuring symptoms of TLD (INSET), clinical and ambulatory EEG measures reflecting the location and type of anomalous EEG activity, measures of handedness and brain laterality, use of specific recreational drugs, and brain injuries. The final model defined the S-ESP group as right-lateralized females scoring high on INSET items reflecting jamais vu and primitive visual or auditory hallucinations. A significant interaction was found between gender and EEG anomalies occurring in the temporal lobes and sometimes extending to adjacent areas, but not generalized over the whole scalp. These anomalies were positively related to S-ESP in females and negatively in males. The effect for females was contributed entirely by activity other than slowing (mostly spiking, sharp waves, and bursts of beta or alpha) that occurred in the left hemisphere, sometimes extending bilaterally to the right temporal, or the frontal lobes. These exploratory findings need to be cross-validated before the results can be considered conclusive.

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Introduction

Research by Neppe (1983b) and Persinger (1984; Persinger & Vaillant, 1985) has provided evidence for an association between subjective paranormal experiences (SPEs) and the temporal lobes of the brain. This evidence is based on correlations between scores on questionnaires asking subjects about personal experiences such as ESP, out-of-body experiences (OBEs), mystical experiences and apparitions, and positive responses to questions about symptoms characteristic of temporal lobe dysfunction (TLD). However, this research has been restricted to 'normal subjects' whose symptomatology was not of such a degree as to classify them as having temporal lobe disease. Additional background on this research can be found in Palmer and Neppe (2003).

The purpose of the present project, the primary results of which were reported previously (Palmer & Neppe, 2003), was to see if these results could be replicated with a clinical sample. The computerized files of 100 of Neppe's neuropsychiatric patients were blind rated for TLD and SPEs by two independent raters. TLD diagnosis was based on four criteria: (1) responses to 16 items from Neppe's short INSET questionnaire that reflect various symptoms characteristic of TLD that can afflict a patient at any time; (2) etiological predisposing factors including (a) brain insults such as concussions, tumors, and encephalitis and (b) use of certain recreational drugs, (3) results of waking, sleeping, and ambulatory EEGs, and (4) response to prescribed anti-convulsant (A-C) medications. SPE scores were based on 4 item scores from the INSET addressing frequency of S-ESP experiences, OBEs, and 'sense of presence' (apparitions). In support of the hypothesis, the TLD group had a significantly higher mean on the SPE scale than the control group, $p < .05$, one-tailed. However, when gender was introduced as a covariate in an analysis of variance, the TLD hypothesis was no longer supported. A multiple regression analysis predicting SPEs from the four individual TLD criteria plus gender and using all 100 patients indicated significant, independent contributions to the prediction of SPEs by only INSET ($p < .001$) and gender ($p = .004$). This result means that the confirmation of the TLD hypothesis is due entirely to the contribution of the INSET component, confirming a relationship found by Neppe (1983b) with a non-clinical sample. The 4 TLD components did not correlate significantly among themselves, suggesting they were not measuring the same thing. This means that they must be treated separately

in subsequent analyses.

For the present follow-up report, exploratory logistic regression analyses were computed to determine a set of more refined predictors, derived from the global predictors that were previously discussed, which would distinguish those patients who had frequent subjective ESP (S-ESP) experiences from those who had none. The intent of this exercise was to discover and describe the strongest effects in this particular data set, and the *p*-values should be interpreted in this light. We fully recognize that these data need to be cross-validated with an independent sample to be considered conclusive in an inferential sense.

S-ESP experiences were chosen as the criterion variable rather than SPEs in general because only ESP qualifies as a paranormal process. Apparitions and out-of-body experiences are only considered paranormal insofar as they include an ESP or psi component, in which case they would most likely also count as S-ESP experiences. It should be noted, however, that the various SPE categories were highly intercorrelated.

Method and Results

The original sample consisted of 100 of Neppe's (VN's) neuropsychiatric patients most frequently referred to him because of symptoms indicative of TLD. The list was assembled essentially by starting with his most recent cases and working backwards until the quota of 100 was reached. A more detailed explanation of the selection procedure is presented in Palmer and Neppe (2003). There were 68 females and 32 males.[1]

S-ESP experiences were originally coded on a 4-point scale, with 3 = frequent, 2 = occasional, 1 = rare, and 0 = never. By dropping the '1' category, we were able to obtain two groups of approximately equal size that unambiguously reflected the two poles of the construct of interest. The 'S-ESP' group (2 + 3) had N = 53 (46 female, 7 male) and the 'No S-ESP' group (0) had N = 40 (24 female, 16 male). Thus, 93 of the original 100 patients were included in the logistic regression analyses. These patients ranged in age from 18 to 69, with a mean of 42.6. As was the case with the original SPE variable, females were more likely to have

[1]We have no ready explanation for the large predominance of females in the sample. We are aware of no studies indicating a prevalence of TLD among females, but neither are we aware of any studies that refute such a trend. Another possibility is that females are more likely than males to seek treatment for TLD, although this seems unlikely given the debilitating nature of the symptoms experienced by persons with TLD.

frequent S-ESP experiences than males, 69.9% vs. 30.1%, $\mathcal{X}^2$ (1, N = 93) = 16.73, $p < .001$.

Preliminary Regression Analyses

Logistic regression analyses were carried out to determine sets of predictors that could optimally predict S-ESP to a significant degree. Logistic regression is similar to multiple regression, except that it applies when the dependent variable is categorical, as it is in this case. Analyses involving two or fewer predictors used the 'logit model' in SYSTAT 6.0 (Wilkinson, Blank, & Gruber, 1996), but more complex analyses were performed using a maximum likelihood estimation procedure from SAS 8.0. The SAS software gave virtually identical results to the SYSTAT software in test comparisons that both programs could handle. SYSTAT results are reported as z's and SAS results as chi-squares. Discriminant analysis is not appropriate for these data because many of the predictors are not multivariate normal (Press & Wilson, 1987). Also, discriminant analysis does not handle control variables, such as gender in the present case.

We decided to treat separately at the outset each of 3 broad categories of predictors used for the global analyses – INSET, etiological factors, and EEG – plus two new ones, brain hemisphere dominance and age, attempting to find a set of significant predictors. These predictors were subsequently combined to yield the final model. Response to anticonvulsant drugs was not included because this variable could not be effectively broken down into more discrete categories and did not predict SPEs in the global analyses (Palmer & Neppe, 2003).

Because of the potential confounding effect of gender, this variable was included in all the analyses testing the effects of the predictors mentioned above on SPEs. If the interaction term was not significant, the analysis was repeated with the interaction term removed. These later analyses were used to determine if the predictor was significant, controlling for gender. As recommended by Hosmer and Lemeshow (2000), a p-value of .10 (two-tailed) was used as the criterion for inclusion in the models.

INSET (N = 16 predictors): Regression analyses were performed on each of the 16 INSET items (listed in the Appendix), coded on a 0 – 3 scale. The 5 items that were statistically significant controlling for gender are listed at the top of Table 1. These variables, along with gender,

were entered into a series of more complex regression analyses, with the least significant variable being removed each time until the remaining predictors in the model were significant. During this process it was decided to combine 2 of the variables (visual hallucinations and auditory hallucinations) into a single variable, as they had comparable p-values (.191 and .161), were conceptually related, and were moderately correlated with each other, $r_{(97)} = .348$. The final model contained 3 significant predictors: Gender, $\mathcal{X}^2$ (1, N = 92) = 11.33, $p = .0008$; visual/auditory hallucinations, $\mathcal{X}^2$ (1, N = 91) = 6.52, $p = .011$, and jamais vu experiences, $\mathcal{X}^2$ (1, N = 91) = 4.48, $p = .034$. Both INSET effects were positive, meaning that a high score on the item characterized the S-ESP group.

Table 1: Significant ($p < .10$) predictors of S-ESP experiences, controlling for gender

	Item	Description	p^a
INSET:			
	48	Nightmares	.003
	15	Auditory Hallucinations	.025
	13	Visual Hallucinations	.031
	19	Jamais Vu	.037
	7	Memory Disturbances	.091
EEG:			
	LC	Left-Central	.071
		Hemisphere Dominance:	
		Laterality	.008
		Handedness	.011

[a]Uncorrected for multiple analysis

Etiology (N = 6): For the regression analyses on etiological factors, separate codes were created for the 4 recreational drug classes that had more than 5 patients using them to a significant extent: marijuana, hallucinogens (LSD, psilocybin, mescaline), amphetamines, and cocaine. Significant use of any of the above was coded as a separate variable labeled 'drugs'. Because the overwhelming majority of brain insults were concussions, these insults were combined in a single category labeled 'head'. None of these variables significantly predicted S-ESP experiences with gender controlled.

EEG (N = 25): The patient files included details about the presence and nature of specific EEG abnormalities or anomalies, and their locations as indicated by the surface electrodes. These details were not available for 1 patient, a male. Locations could be specified by hemisphere (right, left, bilateral, or general) and lobe [temporal, frontal, central, parietal, or occipital][2]. Two specific types of activity were also earmarked: spiking and slowing (unusual delta or theta-wave activity). The remaining activity consisted of such wave patterns as bursts of fast beta or alpha. Because of the nature of Neppe's patient population, anomalies were more frequent in the temporal lobes than in other areas, and more patients had left temporal anomalies than right temporal ones (45 vs 18). Many possible variables could not be included in the analyses because their frequencies were less than 5. The remaining 25 variables are listed in Table 2.

Of the 25 EEG variables tested, only LC (left central) was significant, $z = -1.81$, $p = .070$. LC is associated with an absence of S-ESP experiences.

Brain Hemisphere Dominance (N =2): Because of its possible relevance to the EEG, we decided to include brain hemisphere dominance as a category for the regression analyses. The patients' files had 2 indirect measures of this variable: 'handedness' and 'laterality'. For handedness, patients were simply asked on the INSET screen if they were left or right-handed. To measure laterality, patients were asked the following three questions: (1) 'Which hand do you write with?' (2) 'Which side do you bat or throw with?' and (3) 'Which side do you kick with?' These questions were intended to establish at a basic level whether or not the patients exhibited mixed functions for controlling basic dominant characteristics, reflecting possible higher brain functions that may be purely on one side or cross into both hemispheres. Laterality and handedness were amplified during the neurological examination by observing which hand was used in certain tests (writing, cerebellar diadokokinesia – a finger nose test) as well as by asking clinically relevant questions.

Both handedness and laterality were recorded as 'left', 'right' and 'both' (also called 'either'). The 'both' option was assigned for laterality when the patient gave inconsistent responses to questions or indicated

[2]These 'lobe' designations represent electrode placements in the 10-20 system.

Table 2: Analyzed EEG codes (N in parentheses)

		Right	Left	Bilateral	Total
Temporal	Spike	RTX(7)	LTX(19)	BTX(6)	TX(27)
	Slow	-	-	-	TS(17)
	All	RT(18)	LT(45)	BT(18)	TEM(54)
Frontal	Spike	-	-	-	-
	Slow	-	-	-	FS(8)
	All	RF(9)	LF(10)	BF(6)	FRO(21)
Central	Spike	-	-	-	-
	Slow	-	-	-	-
	All	-	LC(8)	BC(5)	CEN(12)
Parietal	Spike	-	-	-	-
	Slow	-	-	-	-
	All	-	-	-	-
Occipital	Spike	-	-	-	-
	Slow	-	-	-	-
	All	-	-	-	-
General	Spike	-	-	-	X(33)
	Slow	-	-	-	SLO(31)
	All	RG(7)	LG(5)	BG(14)	GEN(21)
Total	Spike	-	-	-	-
	Slow	-	-	-	-
	All	RGT(25)	LFT(45)	-	-

that they used either hand for some or all of the tasks.

Because over 75% of the patients in the regression sample were right handed, and the same percentage right lateral, it was decided for purposes of the regression analyses to combine the 'left' and 'both' categories. (This is not meant to imply that the two groups are equivalent.) Handedness and laterality were highly correlated in the total sample, $r_{(97)} = .859$ and the regression sample, $r_{(91)} = .866$.

Both variables significantly predicted S-ESP experiences controlling for gender: handedness, $z = 2.58$, $p = .010$; laterality, $z = 2.78$, $p = .005$. Because of the high correlation between the two predictors, we decided to select only laterality for the final model. The direction of the effect indicated that right-laterality (left-hemisphere dominance) was associated with the presence of S-ESP experiences.

Age (N=1): Age had no relation to S-ESP.

The Final Model

Based on the initial stage of variable selection, 4 predictors (visual/auditory hallucinations, jamais vu, left-central EEG, and laterality) were selected, in addition to the control variable, gender. LC dropped out of the final model, which is presented in Table 3. The variables are listed in order of their odds ratios, which in the context of their confidence intervals represent the relative strengths of the relationships. Note that gender is by far the strongest predictor. 83.5% of the possible predictions from the model were concordant[3] and only 13.2% discordant.

Table 3: Maximum likelihood estimates from final logistic regression model

Variable	DF	Parameter Estimate	Standard Error	Wald $\mathcal{X}^2$	Prob. of $\mathcal{X}^2$	Odds Ratio[a]	
Gender	1	2.12	0.60	12.52	.0004	8.32	(2.57/26.93)
Laterality	1	1.70	0.69	6.13	.013	5.49	(1.43/21.15)
Jamais Vu	1	0.78	0.35	5.07	.024	2.19	(1.11/4.33)
V/A Hallu.	1	0.33	0.13	6.49	.011	1.39	(1.08/1.79)

[a]Confidence limits (95%) of odds ratios in parentheses

Interactions with Gender

Temporal EEG: The only predictor variable to significantly interact with gender is an EEG variable labeled TEM, $\mathcal{X}^2$ (1, N = 91) = 6.50, $p = .011$. Patients were coded positive on this variable if their EEGs indicated abnormal activity of any kind in either the right temporal, left temporal, or both. Patients with generalized abnormal activity were not coded positively for TEM, although the generalized activity may have included the temporal lobes. A further examination of this interaction revealed that for females, temporal-lobe abnormalities were significantly associated with the presence of S-ESP experiences, Yates-corrected $\mathcal{X}^2$ (1, N = 65) = 3.88, $p = .049$, $\phi = .279$[4], whereas for males temporal lobe abnormalities were associated marginally with an absence of S-ESP experiences, $p = .091$ by Fisher's exact test, $\phi = -.359$. These relationships are illustrated in Table 4.

[3]This means that for all possible pairings of experimental and control subjects, the model properly classified the two patients 83.5% of the time.

[4]ϕ (*phi*) can be considered as a measure of the effect size.

Table 4: S-ESP experiences by Gender as a function of temporal lobe abnormalities

Females:					Males:				
		S-ESP					S-ESP		
		Yes	No	Total			Yes	No	Total
Temp. EEG	Yes	33	8	41	Temp. EEG	Yes	1	11	12
Abn.	No	13	11	24	Abn.	No	6	9	15
	Total	46	19	65		Total	7	20	27

The previously reported finding (Palmer & Neppe, 2003) that females had higher average code scores for temporal EEG disorder than did males is confirmed with TEM as the criterion variable, $\mathcal{X}^2$(1, N = 99) = 4.57, $p = .033$. 61.8% of females had temporal lobe anomalies, compared to 38.7% of males.

Refinements of TEM: Temporal-lobe abnormalities had been further classified in terms of type (spike, slowing, and other) and location (left hemisphere, bilateral, right hemisphere), as illustrated in Table 2 above. A set of univariate logistic regression analyses were performed to explore whether these more refined variables made a difference for females. Regarding type, the positive relationships between the abnormality and S-ESP were stronger for spikes, $z = 0.91$, and other, $z = 1.81$, than for slowing, $z = 0.15$. For spikes and other combined, the relationship was significant, $z = 2.31$, $p = .021$. Removing patients from the TEM group whose anomalies were restricted to slowing increases the relationship in Table 4 slightly, $\phi = .304$. As for location, the regressions were positive for left-temporal, $z = 1.37$, and bilateral, $z = 0.97$, but negative for right temporal, $z = -0.35$. For left temporal and bilateral combined, the relationship was significant, $z = 2.31$, $p = .021$. Restricting the TEM group to those with only left temporal and/or bitemporal anomalies slightly strengthened the Table 4 relationship for females, $\phi = .329$.

A third refinement was called for by virtue of the significant negative relationship between S-ESP and anomalous firing in the left central area. To take this apparent suppressor into account, patients who survived the preceding cuts were removed from the temporal group if the anomalies extended to the central area. This final pruning of the TEM group increased the effect for females further still, $\mathcal{X}^2$(1, N=65) = 9.80,

$p = .002$, $\phi = .422$.

The TEM female group has now been redefined as consisting of females with abnormal EEG activity other than slowing, either in the left temporal lobe (sometimes extended bilaterally to the right temporal lobe) or to the frontal lobes, only. A comparable description cannot be offered for males because there was only one male positive for TEM who was also positive for S-ESP. The only EEG abnormalities in this patient were spiking in the right temporal lobe. However, males can still be classified, using the same refinements for the purpose of providing a baseline for the females. The new analysis is labeled TEMR, for 'TEM revised', and the new cell frequencies are listed in Table 5. As compared to Table 4, the strength of the EEG-ESP relationship increased substantially for females (.279 vs .422 for ϕ) and slightly for the male comparison group (-.359 vs -.384). 92.9% of females with temporal lobe abnormalities are now correctly classified regarding S-ESP experiences, as compared to 80.5% in Table 4.

Table 5: S-ESP experiences by as a function of temporal lobe abnormalities (TEMR), separately by gender

Females:					Males:				
		S-ESP					S-ESP		
		Yes	No	Total			Yes	No	Total
Temp. EEG Abn.	Yes	26	2	28	Temp. EEG Abn.	Yes	0	8	8
	No	20	17	37		No	7	12	19
	Total	46	19	65		Total	7	20	27

A Regression Model for Females: We decided to develop a logistic regression model for females, selecting variables that were significant for the total sample, variables that interacted significantly with gender, and variables that were significant for females separately (see Table 5). This meant that the variables entering the model initially were: jamais vu, visual/auditory hallucinations, laterality, and TEMR.

All variables met the $p < .10$ criterion except jamais vu ($p = .294$). The remaining variables then defined the final model for females, which is illustrated in Table 6.

The weakness of the contribution by laterality likely results from the fact that for some reason right-lateralized patients were more likely

to be in the TEMR group than left/mixed lateralized patients, corrected $\mathcal{X}^2$(1, N=65) = 3.77, $p = .052$. Correlated predictors reduce individual contributions to regression equations.

Table 6: Maximum likelihood estimates from the model, females only

Variable	DF	Parameter Estimate	Standard Error	Wald $\mathcal{X}^2$	Prob. of $\mathcal{X}^2$	Odds Ratio[a]	
TEMR	1	2.66	0.91	8.53	.004	14.22	(2.39/84.50)
Laterality	1	1.31	0.79	2.78	.095	3.73	(0.80/17.46)
V/A Hallu.	1	0.49	0.19	6.85	.009	1.63	(1.13 / 2.35)

[a]Confidence limits (95%) of odds ratios in brackets

Discussion

The regression analyses succeeded in highlighting specific variables that are significantly associated with S-ESP experiences. However, as noted in the introduction, this outcome resulted from a great deal of 'data-snooping' and some of the significant relationships are likely to be type-one errors. A related problem is that the number of patients in some of the cells is quite low, due to a combination of low Ns overall and extreme splits on some variables. One consequence of this problem is wide confidence intervals for the odds ratios of some regression variables. None of the results from the regression analyses can be considered conclusive until they are cross-validated in an independent sample including a larger number of males. Finally, we recognize that SPEs are multi-determined and the variables addressed in this study almost certainly do not comprise the totality of the factors that are associated with their manifestation.

Gender

Gender was clearly the strongest predictor of S-ESP. This finding should not be surprising to parapsychologists. Schouten (1979, 1981a, 1981b) found that three major collections of spontaneous cases each included more females than males as percipients. This pattern did not show up as clearly in Palmer's (1979) Virginia survey using random sampling techniques, although females were more likely to report waking S-ESP experiences than males to a suggestive degree (p = .052). On the other hand, a survey conducted by the Gallup organization for the European Value Systems Study Group with a large sample of 18,607

persons from the United States and various European countries found a statistically significant difference in reported psychic experiences favoring females (Haraldsson & Houtkooper, 1991). The 10% difference between males and females found by these authors is actually similar to that found in Palmer's (1979) total sample, but the latter did not reach significance because of the much smaller sample size. Back to the other hand, a large random sample collected by Blackmore (1984) yielded no significant difference between males and females in the reporting of telepathic experiences. Nevertheless, the weight of the evidence favors the conclusion of more reports of ESP experiences among females than among males.

It is possible that the gender differences regarding S-ESP experiences found in previous research could be reporting artifacts. In other words, women might simply be more prone to report S-ESP experiences than men. Schouten discounted this reporting artifact in his collections from Britain (Schouten, 1979) and Germany (Schouten, 1981a), because he found that females were not more likely than males to report cases in which they were not involved as percipient or target person. On the other hand, females did predominate among these outside reporters in the American collection (obtained by Louisa Rhine), so the reporting artifact was considered to be a viable interpretation for this sample (Schouten, 1981b). This explanation is less likely to apply to the positive random-sample studies (Haraldsson & Houtkoopper,1991; Palmer, 1979) because the solicitations were targeted to specific individuals randomly selected from a target population. Rhine's cases, on the other hand, came from responses to published appeals and from persons who had heard of the Duke University Parapsychology Laboratory and wanted to share their experiences. As more initiative was required from Rhine's respondents than those who had been selected randomly, the Rhine collection is more likely than the random surveys to have been influenced by reporting artifacts.

The present study, while using a non-random sample, is nonetheless more similar methodologically to the random surveys than to Rhines collection, as VN solicited his accounts of S-ESP experiences individually from his 'captive audience' of patients. On the other hand, it is still possible that VNs male patients were reluctant to mention S-ESP experiences to VN face-to-face, or they may have suppressed their S-ESP experiences per se more than females, even when they have the same temporal lobe condition. At any rate, the reporting artifact in-

terpretation needs to be taken seriously in the present study, although it certainly cannot be considered confirmed. Finally, it should be noted that reporting artifacts cannot account for the gender differences in EEG variables found in the present study, which in turn were shown to relate to S-ESP.

INSET

Total INSET scores were found to be a strong predictor of SPEs in the main analysis. In the regression analyses, two items (or item clusters) were found to independently predict S-ESP in the positive direction: visual and auditory hallucinations, and jamais vu.

Only certain kinds of visual and auditory hallucinations are considered by VN to possibly be associated with TLD. For visual, these are movements and distortions in shape or size; for auditory, they are buzzing, ringing, and hissing sounds. The auditory and visual hallucination items were combined to form a single item, which admittedly gave them a built-in advantage in entering the final regression model. However, the combination made conceptual sense and the items in isolation were among the four strongest independent predictors of S-ESP, controlling for gender. Visual/auditory hallucinations also makes sense as a predictor of S-ESP for the simple reason that most S-ESP experiences are themselves visual or auditory hallucinations, albeit ostensibly veridical ones.

Although the hallucinations coded for TLD are much more primitive than the content of most S-ESP experiences, the relationship between visual/auditory hallucinations and S-ESP suggests that there are important commonalities in how the two types of experiences are processed in the brain. This relationship also reminds us that ESP per se and the hallucinatory experiences that often carry it are intertwined and cannot be easily teased apart. Thus, when we find correlates of S-ESP we might be finding correlates of hallucinatory activity rather than the ESP process. Resolving the ambiguity will require comparing the correlates of S-ESP experiences with those of other hallucinatory experiences that we can safely assume lack an ESP component.

The item reflecting jamais vu on INSET had the following wording: 'How often have you been in a familiar place and had the impression that you have never been in that place before? (the opposite of déjà vu called jamais vu - not recognized at all, totally unfamiliar).' Although VN has found that patients at times interpret jamais vu incorrectly, in-

cluding the misclassification of derealization experiences and odd déjà vu experiences as jamais vu experiences, the patients in this research were routinely screened about their positive INSET responses, including jamais vu, so that this error would have been picked up. Nevertheless, the descriptions obtained clinically were occasionally questionable in nature and difficult to compartmentalize into a jamais vu category. VN, who developed the INSET, considers jamais vu to be the best single INSET item for the purpose of screening TLD. This conclusion was borne out by his extensive research on déjà vu, in which the wording of the jamais vu item was identical to that used in the current study (Neppe, 1983a). However, very little research has been conducted on jamais vu per se, and more needs to be done. Finally, certain kinds of déjà vu experiences, as well as certain types of olfactory hallucinations, have in the past been found by Neppe (1983a, c, d) to be closely associated with SPEs but were not studied in this research for reasons outlined in the previous report (Palmer & Neppe, 2003).

The strongest INSET predictor, controlling for gender, was actually the nightmare item. It did not enter the model because of its relatively high correlations with the other INSET items in the mix, particularly jamais vu, $r_{(97)} = .440$. It was not combined with jamais vu to form a single item, as was done with visual and auditory hallucinations, because nightmares and jamais vu do not bear an obvious conceptual relationship to each other. Nightmares are nonetheless an intriguing variable in this context because of evidence that microseizures in the temporal lobes are particularly likely during sleep (Baldy-Moulinier, 1982; Persinger & Schaut, 1988; Stevens, 1982).

Laterality

The most surprising correlate of S-ESP experiences to the authors was laterality, which was intended as a measure of hemispheric dominance. However, our operationalization of laterality was incomplete as it did not measure such attributes as right or left eye dominance, right or left ear lateralization, or right or left foot used to pick up a thumb tack. Additionally, it did not take into account the major marker of hemispheric dominance, namely speech. Speech dominance is not easily measured except by techniques such as the Wada test (Wada & Rasmussen, 1960) of injecting sodium amytal into the carotid arteries, but even this test has its limitations in interpretation. Laterality measures without speech do not assure completely accurate assessment of

which hemisphere is dominant. Nonetheless, pure right laterality as we defined it for the present study almost certainly implies left hemisphere dominance (99% or above), and mixed laterality and left laterality imply likely right hemisphere dominance (80% or above). Still, these are clinical estimates.

There has been some exploration of brain hemisphere laterality in the experimental ESP literature, but the results have been inconsistent. Broughton (1978) reported results from three studies that collectively suggested subjects scored best on a forced-choice type ESP task when they performed the test with the left hand (right hemisphere dominance) simultaneously with a left-hemisphere distraction task. The effect was demonstrated only for males. On the other hand, Maher and Schmeidler (1977) found significant scoring, also restricted to males, only when the forced-choice ESP task was taken with the right hand while the left hand was occupied with a pattern-tracing task designed to activate the right hemisphere. However, this finding could not be replicated (Maher, Peratsakis, & Schmeidler, 1979). Finally, Alexander and Broughton (2001) found that left-dominant subjects, as measured by the Cognitive Laterality Battery (Gordon, 1986), scored somewhat better in a free-response ESP ganzfeld experiment than did right dominant subjects, but the performance of the left-dominant subjects only approached significance ($z = 1.60$). No reports of gender effects were included.

Temporal EEG

The rationale that underlies our research received support from the EEG analyses in the sense that the one area of the brain that seemed to be associated with S-ESP was the temporal lobes (TEM). This singularity may be partly due to the fact that there were much fewer cases of anomalies in other parts of the brain than in the temporal lobes, and there were too few examples of parietal and occipital abnormalities to even analyze.

The effect of EEG abnormalities in the temporal lobes was also found to depend on gender. For females, the relationship was positive, as we predicted at the outset. However, for males it was negative, albeit at a marginal level of significance ($p = .091$). We have no explanation for this reversal for males. The reversal might have been less pronounced, and perhaps nonsignificant, were we able to include data from one male patient with strong S-ESP experiences. Although enough information

was available on this patient to classify him for the original analyses as having EEG abnormalities indicative of TLD, the available EEG report (from another clinic) was not precise enough to allow the more refined coding needed for the logistic regression analyses. Thus, this patient was coded as missing for EEG variables in these latter analyses.

If the overall sex difference in reported S-ESP experiences is due to under-reporting of these experiences by males, then the failure of the TEM hypothesis to hold for males can be brought into question. However, if the critical factor is indeed response bias, one would expect no relationship between TEM and S-ESP, not a reversal (unless one entertains the unparsimonious assumption that the response bias is particularly uncharacteristic of males with anomalous temporal EEG activity). However, it should again be emphasized that the reversal is weak statistically and the relevant male sample size small.

Gender differences in the relationship between TLD and ESP have also been reported in a study using normal participants, although they are not the same as those reported here. Persinger and Richards (1991) found a positive relationship between belief in the paranormal (which is strongly associated with paranormal experiences) and their CPES scale for both genders. However, for females the CPES manifested more as 'ego-alien intrusions', whereas for males they manifested more as 'sensory enhancement'.

We attempted to further refine the nature of the temporal lobe abnormalities predictive of S-ESP in our study by specifying the type of abnormality and its localization by hemisphere, creating a new variable, TEMR. The examination of which temporal lobe (right or left) was most closely associated with S-ESP seems particularly reasonable in light of the interaction between gender and left-side vs. right-side anomalies over the entire scalp. Females showed a greater left focus than males in this analysis. The emergence of laterality as a key variable also might cause one to expect laterality of the EEG anomalies as well. The effect seems to be that for females the anomalies are most likely to affect S-ESP if they are focused in the dominant (left) hemisphere (or bilaterally, which, of course, includes the left hemisphere).

Rationales notwithstanding, the results of the refinements of TEM have less statistical foundation than those discussed previously, as they appeal partly to non-significant trends in the data that were based on only a few data points. Removal of cases where the abnormality consisted of EEG slowing left a slightly stronger relationship between

temporal-lobe abnormalities and S-ESP for females, but the improvement was not significant. Likewise, right-temporal anomalies contributed nothing to the temporal lobe/S-ESP relationship for females, but neither could these right-temporal anomalies be differentiated from the left-hemisphere contributions to a statistically significant degree. This state of affairs is attributable partly to the low number of cases of slowing and right-temporal loci compared to higher frequency anomalies (spikes, paroxysms, sharp waves, etc.) and left-temporal loci. The best that can be said is that effects were only demonstrated for higher EEG-frequency abnormalities that occur in the left temporal lobe.

We also excluded from the TEMR group cases in which the anomalies extended to the central area, because of the significant negative relationship between left central EEG anomalies (controlling for gender) and S-ESP. This simplified the model further by effectively restricting extension of the temporal lobe abnormalities to the frontal lobes. Moreover, the left-central finding could conceivably indicate that anomalies outside the temporal lobes might be S-ESP-inhibitory. Generalized anomalies observed over the whole scalp, controlling for gender, also related negatively to S-ESP experiences, although not significantly so, $z = -1.56$, $p = .119$.

Indirect empirical support for the TEMR model as defined above comes from an experiment by Alexander (2000), who found that a reputedly psychically gifted right-handed female showed excess fast EEG activity in the left temporal and frontal lobes when engaged in four marginally successful ($p = .056$) remote viewing trials as compared to matched control periods. The participant also scored high on the Complex Partial Epileptic Signs (CPES) scale (Persinger & Makarec, 1993).[5]

An examination of Table 5 reveals that prediction of S-ESP was better for females who had temporal lobe EEG anomalies than for those who did not. The poor discrimination for the latter group could be explained by noting that even with the important advantage of ambulatory EEG we only had EEG data from patients for relatively brief periods of time. It is possible that if more EEG data could have been collected, some members of the non-TEMR group who had S-ESP experiences might have revealed EEG anomalies that would have placed them in the TEMR group. Additionally, as far as VN is aware, and cer-

[5]Although Palmer had heard Alexander's paper reported at a conference over a year ago, he had not remembered the specific results at the time he was conducting the regression analyses. His memory was refreshed by Alexander when he shared our results with her after the analyses had been completed.

tainly based on the written reports of patients' experiences during ambulatory EEG, no patient in this sample had any kind of SPE during the EEG measurement periods. Consequently, these EEG measures are trait, not state variables. In VN's original research linking temporal lobe symptomatology with SPEs, he reported that there was both a state and a trait correlation of SPEs with temporal lobe symptomatology in an ostensibly normally functioning population (Neppe, 1983b).

The Temporal Lobes and Psychopathology

Finally, we would like to stress a more general point. The finding that persons with TLD symptoms have more S-ESP experiences than those with the other neurological disorders represented in our sample in no way implies that S-ESP experiences are the product of a diseased brain. Clearly, many people who have S-ESP experiences are in good neurological health, as was borne out by Neppe's original sample of members of the South African Society for Psychical Research (Neppe, 1979; 1983b). What we sought to find out in this study was what parts of the brain might be involved in SPEs. Our guess is that activity in the temporal lobes may indeed be relevant to SPEs, but this activity need not reach the extremes evidenced by some of the patients in our sample. Persinger (1983), for example, has suggested that mystical experiences, including S-ESP, might be associated with micro-seizures in the deep structures of the temporal lobes. In most cases, these micro-seizures would not be considered in any way pathological. A useful adjunct to the present study would be to explore the proportion of 'normal' participants who would be classified as S-ESP-positive using the same S-ESP questions employed in the present study, and, furthermore, to see if the INSET items reflecting TLD are as predictive of S-ESP experiences in this 'normal' population as they are in the patient population.

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Appendix

TLD Items on INSET

(1) How often do you have ( ) fits, ( ) seizures or ( ) 'peculiar spells'?

(2) How often have you had a ( ) blackout or ( ) lost consciousness for a short period for no reason?

(3) How often have you had ( ) grand mal or ( ) petit mal or ( ) myoclonic or ( ) psychomotor seizures?

(4) How often do you have or are you told that you at times lose contact with ( ) staring spells or ( ) absences or ( ) episodes where you have a blank look on your face ( ) for seconds or ( ) minutes not hours?

(6) How often have you for a very short time like seconds or minutes been completely unaware that you did or been told that you did any of the following: ( ) odd behaviors like ( ) buttoning/unbuttoning; ( ) chewing/mouth movements or ( ) other unusual movements or ( ) doing very strange things or ( ) saying strange things or ( ) finding yourself in places you don't remember going to or ( ) jerking the arms?

(7) How often do you ( ) have clear cut gaps in your memory during which you totally cannot remember anything for 5 minutes or more; ( ) miss major sections of TV shows you have been watching; ( ) find yourself driving without remembering how you got there or where you are going; ( ) do strange things automatically? Include only if you think these are not only because of difficulty you have concentrating.

(8) How often do your ( ) moods, ( ) feelings or ( ) thoughts fluctuate within minutes for no reason [like moods which are one moment ( ) very happy then very sad]?

(11) How often do you have odd sensations in part of your body like ( ) floating, ( ) turning or ( ) moving when you were doing none of those?

(12) How often have you come across a smell when there is nothing to cause it? If so, what kind (check applicable)? ( ) medicine; ( ) steak; ( ) perfume; ( ) flowers; ( ) burning; ( ) rotting; ( ) synthetic; ( ) vomit; ( ) incense; ( ) musty; ( ) grass; ( ) bitter; ( ) sweet; ( ) cake; ( ) mustard; ( ) other [*only 'burning', 'rotting' scored*]

(13) How often have you seen any of the following when there is no-one or nothing to cause it? ( ) dots; ( ) lights; ( ) patterns; ( ) shapes; ( ) wrong size; ( ) movements; ( ) distortions; ( ) things moving; ( ) stars; ( ) bugs; ( ) threads; ( ) insects; ( ) none; ( ) other [*only 'movements', 'distortions', 'wrong size' scored*]

(15) How often do you hear any of the following, when there is no-one or nothing to cause it? ( ) buzz; ( ) ring; ( ) sizz; ( ) hiss; ( ) tap; ( ) songs; ( ) whistling; ( ) music; ( ) single word; ( ) arguing; ( ) names; ( ) voices; ( ) jumble; ( ) message; ( ) instructing; ( ) radio / TV; ( ) phone; ( ) nothing; ( ) other [*only 'buzz', 'ring', 'hiss' scored*]

(19) How often have you been in a familiar place and had the impression that you have never been in that place before? (the opposite of déjà vu called jamais vu - not recognized at all, totally unfamiliar)

(23) How often have you found that, for no apparent reason, you are actually reliving things in the past (as if the past flows like a movie screen before you)?

(28) How often do you have sudden, unexplained and uncontrollable attacks of intense fear?

(34) How often do you hear what is being said, yet you cannot understand or make sense of it?

(48) How often do you have frightening nightmares?